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MPSG ANNUAL EXTENSION REPORT

PROJECT TITLE: **Soybean Response to Potassium Fertility and Fertilizer in Manitoba**

PROJECT START DATE: 1 April 2017 **PROJECT END DATE: 31 March 2020**

DATE SUBMITTED: 23 April 2018

PART 1: PRINCIPAL RESEARCHER

PRINCIPAL

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PART 2: EXECUTIVE SUMMARY

Outline the project objectives, their relevancy to pulse and soybean farmers, and a summary of the project to date, including methods and preliminary results.

Background

In recent years, there has been an increase in reports of soybean potassium (K) deficiencies in Manitoba. This is likely a result of the large amount of K removed by soybeans at harvest (1.1 – 1.4 lb K_2O/bu), coupled with substantial increases in soybean acres and improvements in genetic yield potentials. Despite these factors, there has been a lack of comprehensive research on potassium fertility for soybean production in Manitoba. K fertilizer recommendations for soybeans have not been updated for several years.

Research Objectives

1. Determine the frequency of soybean yield response to K fertilizer additions across a range of soil test levels and soil types
2. Assess the effectiveness of different combinations of potash rates and placements, for increasing soybean seed yield
   I. 30 or 60 lb K_2O/ac sidebanded
   II. 30, 60 or 120 lb K_2O/ac broadcast and incorporated
3. Investigate the capacity for MB soils to retain added K in non-exchangeable forms, which may not be available for crop uptake

Methods

In 2017, four sites were established on fields with varying soil test K (STK) levels, as determined by a site composite spring soil test (Table 1). The target range for these K rate and placement studies was soils with spring soil test potassium levels <100 ppm, the current threshold for recommending K fertilizer on soybeans in MB.

Table 1. 2017 Spring Soil Test K (STK) Values

Site	STK (ppm)
Elm Creek	101
Haywood	61
St. Claude	96
Portage	65

Six combinations of potash (KCl) rates and placements were replicated four times at each site:

- 0 lb K_2O/ac (control)
- 30 and 60 lb K_2O/ac, side-banded
- 30, 60 and 120 lb K_2O/ac broadcast and incorporated

Small plots (3m x 8m) were established with a John Deere 1755 4-row precision planter, with the capability to side-band 2" beside and 2" below the seed row. The variety planted was DKB005-52, with a target plant stand of 150 000 plants/ac.

Preliminary Results

Soil Test K: moist or dry soil?

Soil samples taken from each control plot at the time of planting were analyzed for ammonium acetate extractable K. Each sample was split into two subsamples; one was kept field-moist, the other was air dried and ground. The differences between K analyzed for moist soil compared to a dried soil were inconsistent and often large (Figure 1). Also, samples varied substantially among replicate control plots within the same site.

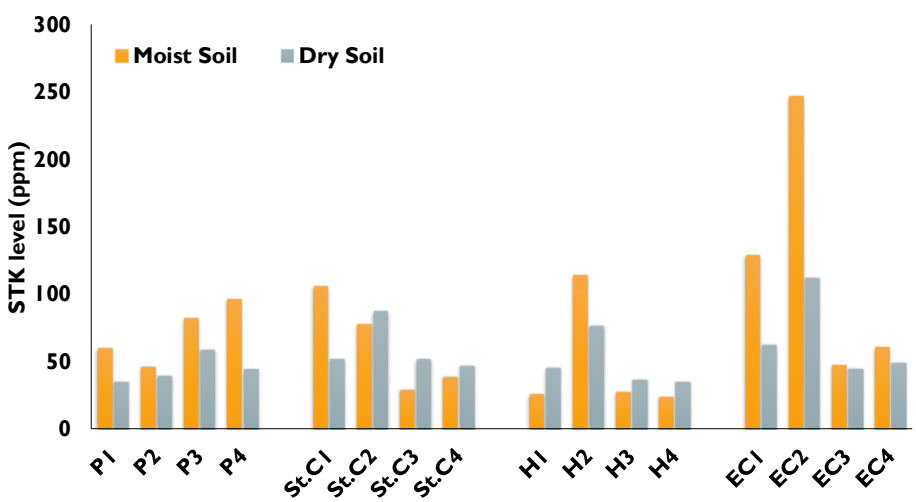


Figure 1. Ammonium acetate extracted STK from 0-6" air dried and field-moist samples taken at planting

In-Season Observations

Several plots showed characteristic K deficiency symptoms of soybeans including interveinal chlorosis, beginning at the leaf margins of lower leaves.

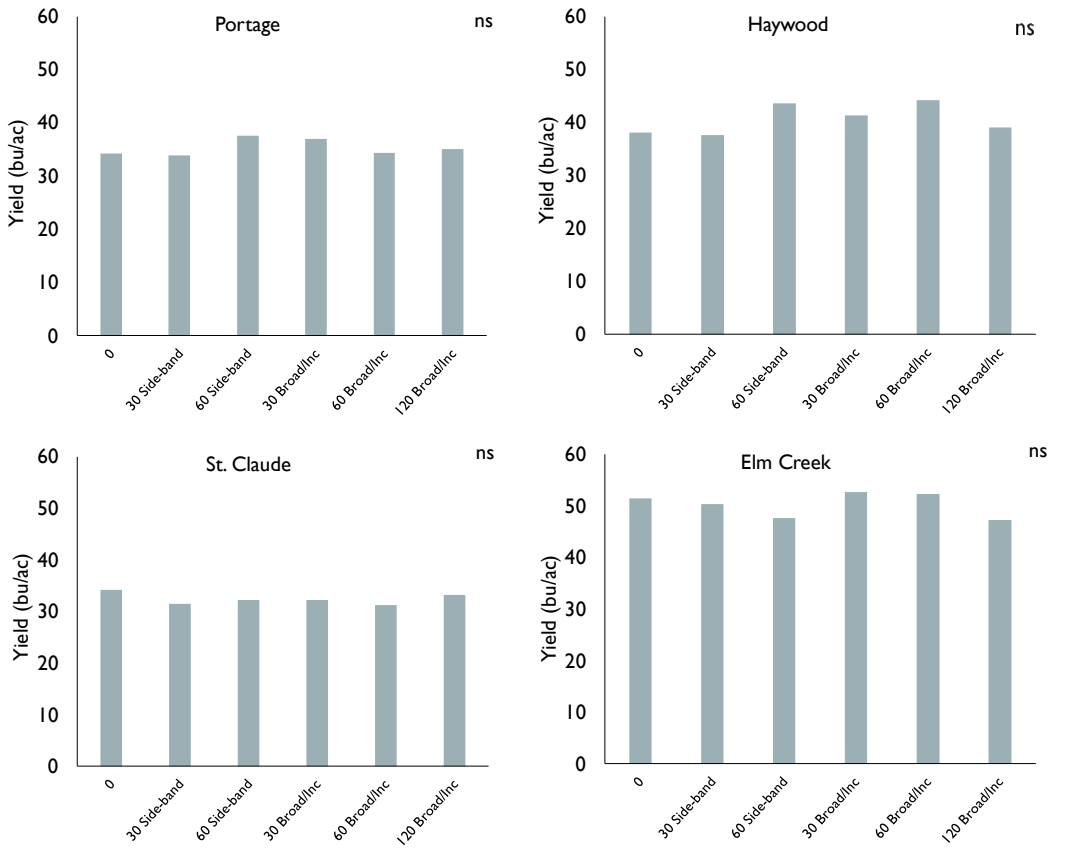
Midseason Tissue Samples

Midseason tissue samples were taken at R2 from each plot and included:

- 10 whole plants per plot (used to determine K uptake)
- 25 uppermost mature trifoliate leaves (to determine if K levels are within the established critical range for this stage)
- 25 stem pieces, from directly above the sampled trifoliate (assessed for K concentration to determine if this is a more sensitive indicator of K nutrition status of the plant than leaf K concentration)

Seed Yield

In 2017, soybean seed yields varied between 30 and 50 bu/ac. Fanzago was the highest yielding site, with an average yield of 48.9 bu/ac. However, in spite of the low concentrations of soil test K and the appearance of visual deficiency symptoms for K during the growing season at several sites, there were no significant yield differences between treatments at any site (Figure 2).



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Effect	**Pr > F**
TRT	0.2034
Siteyr	0.0030
Siteyr*TRT	0.6237

Figure 2. Soybean seed yields for 2017 small plot research sites

Additional Measurements

To better understand potassium dynamics and the effects of fertilization, further analyses will be carried out, including:

- Long term soil extractions to determine ability of these soils to retain K in non-exchangeable forms that may or may not be plant available
- K concentration and uptake from midseason plant tissue samples
- Harvest seed samples will be analyzed to determine K concentration as a potential means to diagnose K deficiency post-season
- Oil and protein analysis on harvest seed samples to determine whether there is any impact from K fertilizer treatment on these quality parameters

On-Farm Trials

On-farm trials were established by the Manitoba Pulse and Soybean Grower at 15 locations throughout Manitoba. The target range for the on-farm trials was soils with spring soil test potassium (STK) levels <150 ppm. Each trial consisted of treated (either 120 lb potash/ac broadcast and incorporated, or 60 lb potash/ac banded) and untreated strips. In addition to the harvest data collected for each entire strip, paired soil and plant samples were collected along treatment strips to determine the level of soil K and plant K uptake at mid-season (R3), as well as seed yield at maturity. Hand harvest samples were taken from the areas sampled midseason. Analyses of midseason paired samples and harvest samples is in progress.

Large scale trial results indicated statistically significant yield <u>increases</u> at SK11 and SK06 and statistically significant yield <u>decreases</u> at SK10 and SK13 (Figure 3), even though SK06 had relatively high concentrations of soil test K (155 ppm) and SK10 had very low concentrations of soil test K (52 ppm).

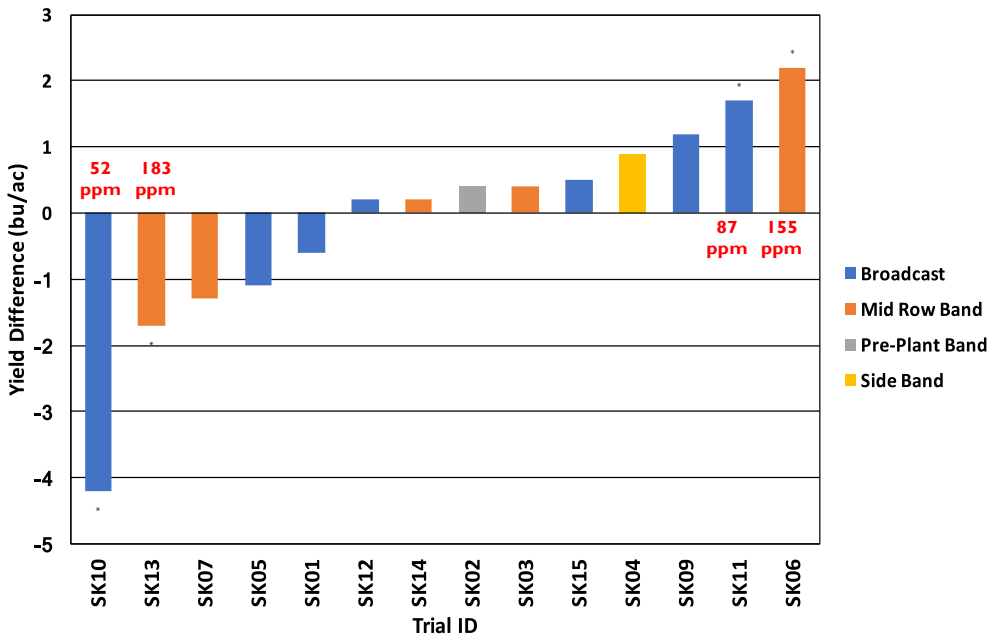

Figure 3. Soybean seed yield differences between potassium treated and untreated on-farm trial strips

Acknowledgements

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PART 3: PROJECT ACTIVITIES AND PRELIMINARY RESULTS

Outline project activities, preliminary results, any deviations from the original project and communication activities. You may include graphs/tables/pictures in the Appendix.

Overall, the project has progressed as expected. The first year of field trials has been completed and the results are being analyzed. Preliminary observations for the project are summarized in Part 2.

The U of MB research team collaborated with the MPSG to host the "Plot Stop" field day on June 30, 2018, which included the K fertilization research site near Elm Creek. Also, interim results for the project have been presented through posters at the Manitoba Agronomists Conference in December 2017 and CropConnect in February 2018, as well as oral presentations to the Manitoba Soil Science Society meeting in February 2018 and the AGVISE Soil Fertility Seminar in March 2018. Photos of the project are available upon request.

APPENDIX

Include up to 1 page of tables, graphs, pictures.